

2017

Corn Silage to Beef Calculator

Garland Dahlke

Iowa State University, garland@iastate.edu

Follow this and additional works at: https://lib.dr.iastate.edu/ans_air



Part of the **Beef Science Commons**

Recommended Citation

Dahlke, Garland (2017) "Corn Silage to Beef Calculator," *Animal Industry Report*. AS 663, ASL R3136.

DOI: https://doi.org/10.31274/ans_air-180814-454

Available at: https://lib.dr.iastate.edu/ans_air/vol663/iss1/9

This Beef is brought to you for free and open access by the Animal Science Research Reports at Iowa State University Digital Repository. It has been accepted for inclusion in Animal Industry Report by an authorized editor of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

Corn Silage to Beef Calculator

A.S. Leaflet R3136

Garland Dahlke, Extension Program Specialist
Iowa Beef Center

Summary and Implications

The Corn Silage to Beef calculator allows corn silage varieties to be summarized in terms of the beef they will yield as a feedstuff. This software has been made available to the general public through Iowa State Beef Center website as a free download at <http://iowabeefcenter.org/calculators.html>

Introduction

The value of corn silage as a feedstuff for beef cattle generally is viewed in terms of grain yield with the accompanying forage yield being ignored or valued to a slight degree as a source of physically effective fiber. The development of more digestible fiber in the forage fraction of the silage and the variability of this digestibility between varieties should cause the user of silage to re-evaluate his criteria in selecting and ranking varieties in terms of value as a feedstuff. The dairy industry has already taken this step in ranking silage in terms of milk producing potential per acre with the University of Wisconsin's "Milk 2006" index which looks at the energy yield of the silage per acre thus the starch in the grain, the digestibility of the forage component and the total silage yield per acre enter into the equation. With this in mind, this same concept should be applicable to growing cattle.

Materials & Methods

The National Academy of Science Engineering and Medicine (NASEM) has recently published an updated version of their guidelines for the nutrient requirements for beef cattle. This document outlines in some detail the conversion of feed energy to growth in cattle. The total digestible nutrients (TDN) and net energy content (NE_m & NE_g) of the feed can be obtained quite conveniently with the use of a commercial feed testing laboratory. The use of a 48 hour NDF digestibility greatly adds to the existing approximate analysis testing of the feedstuff when estimating energy content since this digestibility of feed fiber is of sizable variation between varieties of corn silage. This nutrient data is then applied to a standardized 900 pound steer to allow for an illustration of how much potential growth is allowed per unit of silage. Finally, the actual production data must be incorporated into the model. This involves yield data for the varieties involved along with production and harvest costs. The equations used to generate the results are listed as follows:

Calculations from Corn Silage to Beef Worksheet

Dry Matter intake (DMI)- take the lower of these two equations

$$1. \text{NASEM DMI} = ((408^{0.75} \times (0.2435 \times \text{NE}_m \times 2.2045 - 0.0466 \times (\text{NE}_m \times 2.2045)^2 - 0.0869)) / (\text{NE}_m \times 2.2045)) \times 2.2045$$

$$2. \text{NDF DMI} = (900 \times 0.012) / (\text{NDF}\% \times 0.01)$$

DMI in pounds

Weight Gain from Energy and Protein - take the lower of these two equations

$$\text{Allowable gain from energy intake} = \text{ADG-e} = ((13.91 \times 358.71^{0.6837} \times \text{km}^{0.9116})) \times 2.2045$$

ADG-e in pounds / day

$$\text{km} = ((\text{DMI} \times \text{NE}_m - 6.33) / \text{NE}_m \times \text{NE}_g)$$

NE_m and NE_g in Mcals per pound

If NE_m and NE_g are not provided directly to the program, but the nutrient profile is provided then

$$\text{NE}_m = (4 \times \text{DMd}\% \times 0.01 \times \text{CP}\% \times 0.01 + \text{NDF}\% \times 0.01 \times \text{NDFd}\% \times 0.01 \times 2 + \text{Fat}\% \times 0.01 \times 9 \times \text{DMd}\% \times 0.01 + 4 \times \text{DMd}\% \times 0.01 \times 0.01 \times \text{NFC}\%) \times 0.275)$$

Then TDN is calculated

$$\text{TDN} = (\text{NE}_m + 0.132) / 0.01318$$

$$\text{NE}_g = \text{TDN} \times 0.01318 - 0.459$$

NFC = nonfiber carbohydrate

DMd = dry matter digestibility

$$\text{Allowable gain from protein intake} = \text{ADG-p} = ((29.4 \times 5.673 + \text{NetMP}) / 268) \times 2.2045$$

ADG-p in pounds / day

$$\text{NetMP} = ((\text{FeedMP} + \text{MicrobialMP}) - 301) \times (0.834 - (298.8 \times 0.00114))$$

$$\text{Feed MP} = (\text{CP}\% \times 0.01 \times \text{DMI} \times 0.32) \times 453.6 \times 0.8$$

FeedMP in grams

Select lower of the two:

$$\text{MicrobialMP1} = 0.13 \times (\text{NFC} \times 0.01 \times \text{DMI} + \text{DMI} \times \text{NDFd} \times 0.01 \times \text{NDF}\% \times 0.01 \times 0.85) \times 453.6 \times 0.64$$

$$\text{MicrobialMP2} = 0.68 \times \text{CP}\% \times 0.01 \times \text{DMI} \times 453.6$$

MicrobialMP in grams

To calculate the amount of urea needed

$$\text{Urea required} = (\text{MicrobialMP1} - \text{MicrobialMP2}) / (250 \times 0.01 \times 453.6)$$

Grams of urea

Cost of Urea = user defined per ton

Iowa State University Animal Industry Report 2017

Beef Per Acre = (DM/acre)/DMI x ADG)
Pounds

\$/lb Beef = Cost per Acre / Beef per Acre

If urea balance is figured in then the cost of urea is added to the \$/lb Beef

Cost of corn silage production = user defined per acre

Yield of corn silage = user defined per acre

Varieties are ranked on \$/lb Beef

Results & Discussion

With corn silage, MicrobialMP1 will always be higher and not used due to the urea fermentation potential of corn silage (not enough nitrogen to utilize the energy). Therefore, MicrobialMP2 is always selected unless we add urea. Different varieties have differing amounts of urea fermentation potential required to balance, thus if the "Urea Balance" selection is marked "yes" in the program, then urea is added to balance and crude protein (N) is no longer limiting to ADG, thus varieties can be compared on energy produced per acre when this is done rather than limiting their potential by plant protein. The urea is given a cost on the worksheet by the user which is factored into the cost of gain based on how much urea is needed.

Another adjustment that is allowed is that for cattle consuming high levels of starch and the probable depression in fiber digestion in their diet. Cattle may be on all forage diets or they may be on a feedyard fattening protocol. With the cattle on the high starch rations used for fattening the value of the digestible NDF is reduced to 50% of the 48 hour laboratory value. This reduces the value of fiber digestibility, but still credits it to some degree in the ration. The input / output appears as such: